Sichang He (Steven)

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Ph.D. Student in Computer Science

GitHub & YouTube @SichangHe

University of Southern California

Website

EDUCATION

University of Southern California (USC) — Aug. 2024 – present. Los Angeles, USA

Ph.D. student in Computer Science — Advisor: Dr. Harsha V. Madhyastha

- Research focus: User-facing enhancements of the Web.

Duke Kunshan University (DKU) & Duke University Dual Degree — Aug. 2020 – May 2024

B.S. in Data Science (by DKU) & — Kunshan, China &

B.S. in Interdisciplinary Studies (Subplan: Data Science, by Duke) — Durham, NC

- In addition to studies in Data Science, completed many courses in Computer Science and Mathematics, effectively emulating a triple major.
- Selected courses with projects:
  * Computer Network Architecture (A+): async TCP server and client in Elixir and CLI REPL shell in Rust.
  * Data Acquisition and Visualization (A): Poster using D3.js, Svelte, and TypeScript.
  * Computer Organization and Programming (A+, at Duke): Binary search tree in MIPS assembly and ring buffer in C; fifth place in PizzaCalc assembly length optimization competition (68 lines).
  * Probability, Random Variables and Stochastic Processes (A): PageRank DKU website as a Markov chain.
  * Numerical Analysis (A+); Intro Abstract Algebra (at Duke), Complex Analysis (A).
- Achieved full grade on all five courses at Duke University in the Fall 2022 semester.

Zhixin High School — Aug. 2017 – Jun. 2020 Guangzhou, China

- Chemistry Olympiad competition team; Biology Olympiad competition team.

CONFERENCE PUBLICATION

[1] **Sichang He**, Italo Cunha, and Ethan Katz-Bassett. "RPSLyzer: Characterization and Verification of Policies in Internet Routing Registries". In: *Proceedings of the 2024 ACM Internet Measurement Conference.* Nov. 2024, to appear. URL: `https://github.com/SichangHe/internet_route_verification/releases/tag/imc-camera-ready`.

[2] **Sichang He**, Beilong Tang, Boyan Zhang, Jiaqi Shao, Xiaomin Ouyang, Daniel Nata Nugraha, and Bing Luo. "FedKit: Enabling Cross-Platform Federated Learning for Android and iOS". In: *IEEE INFOCOM 2024-IEEE Conference on Computer Communications Workshops (INFOCOM WKSHPS).* May 2024, to appear. URL: `http://www.arxiv.org/pdf/2402.10464`.

RESEARCH EXPERIENCE

Independent Researcher on Internet Route Verification — Apr. 2023 – present

Independent research, Federal University of Minas Gerais, Brazil (Remote) — Supervisor: Dr. Italo Cunha

- Designed and implemented an efficient and comprehensive parser for the Routing Policy Specification Language (RPSL), a language used in the Internet Route Registry to document public inter-domain routing policies, guide public peering, and aid routing issue troubleshooting.
  * Studied and complied with RPSL semantics in RFCs, covering over 99% of all real-world RPSL use cases.
  * Optimized the parser to generate detailed verification reports for tens of millions of routes within an hour.
  * Leveraged abstract algebra and Rust language features to guarantee correct branching in report generation.
- Employed the RPSL parser to verify observed inter-domain routes; analyzed verification reports and identified common RPSL usage patterns and usage mistakes.
  * Provided tooling to verify routes against the RPSL, helping improve inter-domain routing security.

* Identified and implemented checks for 9 potential reasons why routes fail to match the relevant RPSL.
* Conducted interactive data analysis in Rust with the Rust Evcxr REPL.

Research Assistant for Mobile Federated Learning (FL) Project   Mar. 2023 – May. 2024
The FedCampus Team, EdgeIntelligence Lab, DKU   Supervisor: Dr. Bing Luo

- Authored FedKit, open-source SDKs to streamline real-world FL experiments across Android and iOS devices, enabling training shared ML models collaboratively without sharing private data on smartphones.
  * Developed a pipeline to convert, train natively, and aggregate the same ML models across Android and iOS.
  * Implemented cross-platform continuous model delivery and training, enabling iterative FL design in production.
  * Contributed to the Flower FL framework: revamped the Android example; helped correct the iOS example.
  * Implemented on-device ML training with the experimental TensorFlow Lite and the proprietary Core ML.
- Led and managed the systems development for the FedCampus Android/iOS app, leveraging personal health data from over 100 participants to conduct real-world FL and federated analytics experiments on DKU campus.
  * Supervised and mentored four undergrads and one M. Eng. student in mobile and web development.
  * Interviewed and recruited a UI programmer and a designer.
  * Investigated and led core technology adoption, including Flower, Kotlin, and Flutter, facilitating development.

Research Assistant for Search Engine Research Project   Dec. 2021 – May 2023
The Search So Team, DKU   Supervisor: Dr. Jiang Long

- Developed a feature-rich open source web scraper in async Rust to scrape DKU sites, intranet, and Duke sites.
- Improved backend HTML processing, frontend interface, and version control.

PRESENTATION

[1] Bing Luo and **Sichang He**. *FedCampus: a Privacy-preserving Data Platform for Smart Campus with Federated Learning and Analytics*. Flower AI Summit, 2024. Mar. 2024. URL: https://www.youtube.com/watch?v=K7yu2jvu_t8.

TEACHING EXPERIENCE

Teaching Assistant for COMPSCI 201, DKU   Nov. 2021 – Mar. 2022
Introduction to Programming and Data Structures   Instructor: Dr. Jiang Long

- Hosted weekly lab sessions and office hours.
- Created text-based tutorials and the first video tutorial on development environment setup.

Math & CompSci. Tutor, Academic Resource Center, DKU   May 2021 – May 2022

- Tutored dozens of students in MATH 201 - Multivariate Calculus, MATH 105 - Calculus, and COMPSCI 201.
- Obtained CRLA's International Tutor Training Program Certification, Level I .

AWARDS

- Senior Scholar-Athlete Award through the Running Club, DKU Athletics (Apr. 2024)

- Silver Medal, International Genetically Engineered Machine (iGEM) 2022 DKU Team (Oct. 2022)
  Developed the team wiki independently; helped non-technical members adopt Git; validated protein designs with modeling software.

- Dean's List (Spring 2021) & Dean's List with Distinction (Fall 2021, Fall 2022, Spring 2023), DKU

- Chancellor's Scholarship & UGRD Entrance Scholarship, DKU (merit-based, Fall 2020 – Spring 2024)

Side Projects

Open Source Developer & Maintainer of <u>mdBook-KaTeX</u> Nov. 2022 – present

Math expression preprocessor for <u>mdBook</u> written in Rust; over 60,000+ downloads on crates.io GitHub

- Took over maintainership by publishing a fork when it was unmaintained.
- Fixed numerous bugs and developed new features, resolving more than 20 GitHub issues others had opened.
    * Fixed the GitHub CIs for MUSL Linux and Windows builds.
    * Fixed persisting CommonMark Markdown rendering bugs and error handling bugs.
    * Added support to include math expressions source, enable MathML for accessibility, and use custom delimiters.
- Improved speed by over 10 times by adopting parallelism and avoiding repeated rendering.
- Deprecated the problematic static CSS feature gradually and provided an alternative.

Author of Open Source <u>Web Forum</u> Using Ruby on Rails Jun. 2022 – Aug. 2022

- Featured infinitely nested comments; deployed on Heroku.

Outreach

- Chinese Editor & Translator at DKU Intersections Journal Jun. 2021 – Aug. 2021
  Co-translated three English articles into Chinese; reviewed and edited multiple articles and <u>Intersections' website</u>.
- Active DKU Running Club and Badminton Club member Fall 2020 – Spring 2024

Skills

Natural Language   Mandarin (native), Cantonese (fluent).

Programming Language

- Invested and proficient: Rust, Python, Elixir, JavaScript.
- Used in projects: Kotlin, Dart, Swift, Ruby, Java, Lua, TypeScript, Svelte, HTML, CSS, C, SQL, Racket, LaTeX.
- Familiar: C++, Fish, Bash, Julia, Go, VimScript, Elisp, Mathematica, MATLAB, Scala, R.

Computer Software

- Selected frameworks/libraries: Django, Phoenix Framework, Rayon, Tokio, PyParsing, Tailwindcss, D3.js.
- Rich experience in setting up and computing on remote servers via SSH, Tmux, and Neovim.
- Custom <u>terminal and keyboard-centric development environment</u> with Neovim, tiling window manager Yabai, etc.
- Operating systems installation and exploration: Windows 10 & 11, Arch Linux, FreeBSD, QEMU/KVM, Hackintosh.